

13th International Workshop on International Workshop on
1&2 DIMENSIONAL MAGNETIC MEASUREMENT AND TESTING

Original

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13th

**International Workshop on
1&2 DIMENSIONAL MAGNETIC
MEASUREMENT AND TESTING**

10 - 12 September 2014 – Torino, Italy

Short paper proceedings

Editors

C. Appino, C. Beatrice

Istituto Nazionale di Ricerca Metrologica (INRIM)

C. Ragusa

Politecnico di Torino

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September 10-12, 2014
The 13th International Workshop
on One- and Two- Dimensional
Magnetic Measurement
and Testing
Hotel Majestic | Turin, Italy

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International trade show for the
Coil & Winding industry
Hall 8 | Stand G8 F7
Pordenone Fiere | PN, Italy



January 21 - 22, 2015
The International Forum on
Magnetic Applications,
Technologies & Materials
The Rosen Plaza Hotel
Orlando, FL | USA

www.laboratorio.elettrofisico.com





Welcome to Torino

It is our great pleasure to invite you to the 13th International Workshop on 1&2 Dimensional Magnetic Measurement and Testing, which will be held in Torino on 10 - 12 September 2014. The meeting, first established in 1991, is mainly devoted to theoretical, experimental, and applicative advances on the methods of characterization of magnetic materials. It aims at promoting and reinforcing links between basic and industrial research in the field of magnetic measurement and testing.

The meeting will provide a forum for discussion on various aspects of magnetic measurement and testing through a broad range of topics. The conference will offer an appealing technical program, with keynote, invited, and contributed oral or poster presentations, arranged in the traditional single plenary session.

The program of the Workshop includes 41 communications, 4 keynote talks and one plenary lecture.

The Workshop will be held in the elegant premises of the Hotel Majestic, located in center town, at walking distance from the major touristic attractions of Torino.

The meeting is jointly organized by the Istituto Nazionale di Ricerca Metrologica (Electromagnetics Division) and Politecnico di Torino (Energy Department). We would like to thank our co-workers and the International Steering Committee for their help in organizing the event. We acknowledge kind support by the Torino City Council, the Italian Magnetism Association, and the IEEE Italian Chapter. Special thanks are due to Laboratorio Elettrofisico and Brockhaus Measurements for sponsoring the event.

On behalf of the local organizing and programme committee, we wish you an enjoyable Workshop and a most pleasant stay in Torino.

C. Appino, C. Beatrice, C. Ragusa

2dm Conference Chairs

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Email: conference@2d-m.it ; URL: www.2d-m.it

Scope of the Workshop

The meeting will be devoted to theoretical, experimental, and applicative advances on the methods of characterization of magnetic materials. It aims at promoting and reinforcing links between basic and industrial research in the field of magnetic measurement and testing.

Conference topics:

- Basic problems, magnetisation processes, domain structures.
- 1D and 2D measurements in soft magnetic materials.
- Power electronics and high-frequency measurements.
- Characterization of permanent magnets.
- Measurements in industry.
- Non-destructive magnetic testing, magnetic sensors and actuators.
- Transformers, motors, numerical modeling.
- Magnetic metrology and measuring standards.

Venue and transportation

The 2dm 2014 Conference will be held on 10 - 12 September at Starhotel Majestic. The elegant Starhotel Majestic is located in the heart of Torino, just a short walk from the city's historic center, opposite the Porta Nuova railway station.

The hotel, featuring 19th-century furniture, fine fabrics, and period chandeliers, offers third-millennium travelers the same warm atmosphere of the late 1800s. During a recent renovation, the Starhotels Majestic was able to fully recover the original refinement of its decor and the elegance of its interiors.

The hotel is around 20 km from the International Caselle-Sandro Pertini Airport and can be easily accessed by bus. Take the bus to the city-centre and get off at Stazione Porta Nuova (final stop).

How to get to Torino

From Torino Caselle airport

The Torino International Airport at Caselle is situated 16 km from the city centre. Strada San Maurizio 12, Caselle Torinese (TO)

phone: +39 011 567 6361/6362

fax: +39 011 567 6420

BUS

The SADEM coach service (blue buses) connects the airport with Torino Porta Susa and Torino Porta Nuova rail and subway stations. On-line departures timetable is available. The bus leaves just in front of the arrivals exit of the airport. One-way travel takes about 40 minutes. One-way fare is EUR 6.50. Tickets can be purchased at the Tourist bureau, ticket office, ticket machine (arrivals level), and on-board (EUR +1,0 extra charge).

TAXI

The taxi rank is on the arrivals level by the domestic/EU flight exit. The journey takes about 30 minutes from the airport to the city centre, the fare is approximately EUR 40 in the daytime.

Pronto taxi: phone +39 011 5737

Radio taxi: phone +39 011 5730 / +39 011 3399

CTA (Consorzio Taxi Aeroporto) provides a personalized taxi/van/limousine service 24 hours a day.

CAR RENTAL

Car rental is possible at the airport, with these companies: Auto Europa, AVIS, Budget, E@sy Car Italia, Europcar, Hertz, LocautoRent, Maggiore, Sixt. The offices are located inside the multi-storey car park and in the arrivals lounge.

From Milano Malpensa airport

See SADEM lines timetable for links to Milano Malpensa airport. One-way fare is EUR 22,00. The trip takes two hours.

By train

Torino has two international railway stations, Porta Nuova and Porta Susa, in the downtown area. They are connected by Line 1 of the city subway and by several metropolitan trains. On-line timetables are available.

By car

Torino can be reached by means of five motorways:

- A32 Torino - Fréjus from France;
- A5 Torino - Monte Bianco from France and Switzerland;
- A4 Torino - Milano - Venezia from Central and Eastern Europe;
- A6 Torino - Savona from Liguria and the South of France;
- A21 Torino - Piacenza from Central and Southern Italy.

All motorways link up with the Torino ring road (Tangenziale A55), from where you can reach the city centre.

Moving in Torino

The conference centre is within walking distance from most of the hotels in Torino and the major attractions in the city centre.

The Gruppo Torinese Trasporti (GTT) runs the Torino main public transport system (trams, buses and the underground line). Almost all public transport services begin at approximately 5 a.m. and run into the night (until midnight or 1:00 a.m.).

On-line itinerary planning by bus public urban transport is available by means of Google transit.

Ordinary urban tickets cost EUR 1,50 and are valid for 90 min. from the first validation (only punch the ticket once, on the first boarded vehicle, within the first stop) on urban lines and on city lines of GTT suburban lines. It is also valid for a metro trip within the 90 minutes validity. They can only be used by one person. Booklet of 5 (EUR 6,50) and 15 tickets (EUR 17,50) each are available (also in chip -card version). All tickets must be purchased before boarding the buses, at underground stations, tabacconists or newspaper agents.

Bike sharing - TO Bike

The service in Torino is delivered by TO Bike, and is always free of charge for the first 30 minutes of each use. After the first half hour the service is charged at the rate of EUR 1,00 for the second 30 minutes, EUR 2,00 for the third 30 minutes and EUR 3,00 for all subsequent 30 minute periods. To get access to the bicycles you have to buy a daily pass (cost of EUR 5,00, inclusive of EUR 3,00 credit) when in Torino at the TO Bike store in Via Santa Chiara 26/F (opening Mon-Fri 9:00-20:00, Sat-Sun 9:00-17:00).

<http://www.tobike.it> (Italian only!)

Registration

We recommend that you read carefully the following information before registering.

REGISTRATION FEES (Prices in Euros, VAT included)

Fees	Registration and Payment before 31 July 2014 (Early Bird)	Registration and Payment after 31 July 2014

Regular registration	EUR 350,00	EUR 400,00
Students	EUR 150,00	EUR 180,00
Retiree	EUR 150,00	EUR 180,00

The registration fee includes:

a copy of the Conference Proceedings (Int. J. Appl. Electromagnetics and Mechanics), entrance to the scientific sessions, coffee breaks, buffet lunches, social dinner on September 11, and concert at *Tempio Valdese* on September 12.

Please keep in mind that for Early Bird fees both registration AND payment are due by 31 July 2014.

All details on the Conference registration can be found in the 2dm website: www.2d-m.it

Accommodation

A number of rooms have been set aside for 2dm conference participants. The hotels selected are 2, 3 and 4 star hotels, all downtown located and close to the workshop venue. They all have elegant atmosphere, personalized service and rooms with every comfort. 2, 3 and 4 star hotel rates include breakfast, VAT and service.

City Tax not included. Please note that the city tax varies according to hotel category.

Hotel Category	City Tax per person per night
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2 star hotel	EUR 1,80
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3 star hotel	EUR 2,30
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4 star hotel	EUR 3,20
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Participants are also invited to select and book hotels on their own as rates might be variable (they are becoming more and more market dependant).

All details on hotel reservation can be found in the 2dm website: www.2d-m.it.

Publications

The Programme Committee invites the authors of accepted abstracts to prepare a manuscript for publication on a special issue of the

International Journal of Applied Electromagnetics and Mechanics - IJAEM
(IOS Press, Amsterdam, The Netherlands).

Starting date for submission is April 30, 2014. You will submit the manuscript as an attached PDF document to the following address: conference@2d-m.it. It should be prepared in accordance with the IJAEM instructions for regular submission (see them at <http://www.iospress.nl/journal/international-journal-of-applied-electromagnetics-and-mechanics>).

Manuscript submission deadline is August 31, 2014.

After the peer-reviewing process, the final revised and accepted manuscripts can be submitted for publication to conference@2d-m.it, either as Word or Latex files (additional PDF file will be required for Latex prepared manuscripts). Authors are recommended to follow in detail the IJAEM instructions in final preparation of their manuscript.

The final paper length will be up to 5 journal pages for the contributed papers and up to 8 journal pages for the key-note papers.

Papers accepted for publication are expected to appear on IJAEM in spring 2015.

Social events

Welcome drink

Starhotel Majestic, 10 September 2014 (17:00 - 20:00)

A welcome refreshment will be offered at the Starhotel Majestic on 10 September during the Registration desk opening hours (17:00 - 20:00).

Social dinner

***Circolo dei Lettori*, 11 September 2014 (20:00 - 23:00)**

The 2dm social dinner will take place on Thursday 11 September 2014 at 20:00 at the *Circolo dei Lettori* (Via Bogino 9, Torino).

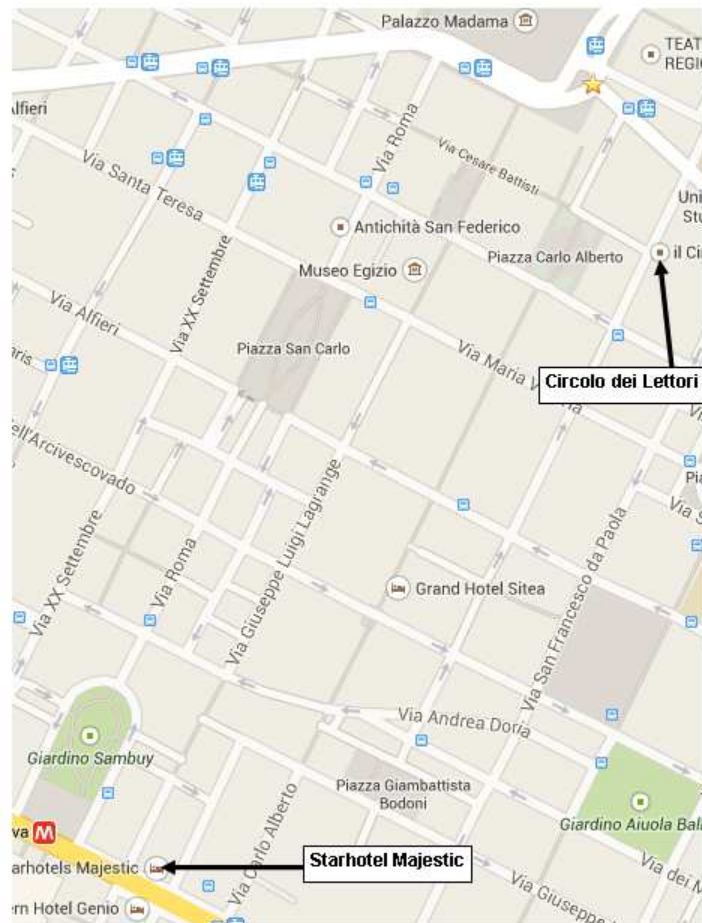
The *Circolo* is based in the seventeenth century *Palazzo Graneri della Roccia*. More than 1000 square metres of pure pleasure, which invite you to relax among people who love knowledge, taste, beauty, in unique surroundings where literature is at home. At the *Circolo dei Lettori* each day there are meetings with authors, book presentations, reading groups, courses, children's workshops.

The dinner will be served in the *Salone d'Onore* (Hall of Honor) and will be an excellent opportunity to taste typical Piedmontese food and wines.

Tickets for the accompanying persons can be purchased at the cost of EUR 45,00 (VAT included). Please, check at the registration desk for ticket availability.

From the Starhotel Majestic: distance 1km, 15 minutes walk.

Walk down through Torino main street (Via Roma) or one of the two most charming pedestrian streets (Via Lagrange or Via Carlo Alberto). Before reaching Piazza Castello and Via Po turn right and you are just a couple of blocks from the *Circolo*.



Cocktail and Concert

Caffè San Carlo and Tempio Valdese, 10 September 2014 (18:30 - 22:30)

Meeting point: Starhotel Majestic

The workshop is pleased to offer to all participants a concert at the *Tempio Valdese* (Corso Vittorio Emanuele II, 23). The concert is part of the *MITO Settembre Musica* (website: www.mitosettembremusica.it/en) music festival and will be preceded by an aperitif in one of the most famous and charming historical cafés of the city centre.

Concert programme:

Robert Schumann
Dichterliebe op. 48

Franz Liszt
Es muss ein Wunderbares sein
Im Rhein, im schönen Strome
Ihr, Glocken von Marling

Richard Strauss
Krämerspiegel op. 66

Ian Bostridge, tenor
Julius Drake, piano

General information

Registration desk opening hours:

Wednesday	10 September	17:00 - 20:00
Thursday	11 September	8:00 - 18:00
Friday	12 September	8:30 - 18:00

Special requirements: If you have any special requirement, please notify the staff at the registration desk.

Internet access: Free wireless Internet access is available in the conference room.

2dm 2014 Conference Programme

The conference presentations will consist of keynote lectures, oral presentations, and posters.

A single plenary session is planned for oral presentations.

Invited speakers:

G. Bertotti (plenary lecture)

Y. Ishihara (keynote)

H. Pfützner (keynote)

M. Enokizono (keynote)

G. Engdahl (keynote)

Oral presentations will be in the format of an 18 minute talk by the registered author using an LCD projector, followed by a 2-minute discussion. Authors are expected to render themselves to the session chair 15 minutes before the session starts, to either upload their presentation to the Conference PC or check their laptop connection. Poster presentations will consist of well-prepared visual materials, to be posted on a designated board (available board area 90 cm width × 140 cm height).

TIME TABLE

Wednesday, September 10

17:00 - 20:00	Registration and welcome drink
---------------	--------------------------------

Thursday, September 11

08:00 - 18:00	Reception and registration
09:00 - 09:15	Welcome Remarks
09:15 - 10:50	ORAL SESSION A
10:50 - 11:20	Coffee break
11:20 - 12:55	ORAL SESSION B
	Lunch
14:45 - 15:40	ORAL SESSION C
15:40 - 16:30	POSTER SESSION with coffee and tea
16:30 - 17:45	ORAL SESSION D
20:00 - 23:00	Conference dinner

Friday, September 12

09:00 - 10:30	ORAL SESSION E
10:30 - 11:20	POSTER SESSION with coffee and tea
11:20 - 12:55	ORAL SESSION F
	Lunch
14:45 - 15:45	ORAL SESSION G
15:45 - 16:35	POSTER SESSION with coffee and tea
16:35 - 17:45	ORAL SESSION H
18:30 - 22:30	Cocktail and Concert

Thursday, September 11 Programme

- 08:00 - 18:00 Reception and registration
- 09:00 - 09:15 Welcome and opening address

Morning Programme

09:15 - 10:50 SESSION A

Session chair: *R. Hasegawa*

09:15-09:50 A-1 (keynote)

Investigation on measurement method of magnetic property of Fe-based amorphous strip for IEC standard
Y. Ishihara

09:50-10:10 A-2

International comparison on SST and Epstein measurements in grain-oriented Fe-Si sheet steel
C. Appino, E. Ferrara, F. Fiorillo, L. Rocchino, C. Ragusa, J. Sievert, T. Belgrand, C. Wang, P. Denke, S. Siebert, Y. Norgren, K. Gramm, S. Norman, R. Lyke, M. Albrecht, X. Zhou, W. Fan, X. Guo, M. Hall

10:00-10:30 A-3

A Single Sheet Tester of Fe-based amorphous strip used for round robin for IEC standardization
M. Tanaka, H. Hagihara, Y. Takahashi, K. Fujiwara, Y. Ishihara, D. Azuma

10:30-10:50 A-4

The measurement methods of magnetic properties of electrical sheet steel - studies on the main error sources
J. Sievert, H. Yang, X. Guo, A. Lin, X. Zhou

10:50 - 11:20

Coffee break

11:20 - 12:55 SESSION B

Session chair: *J. Sievert*

11:20-11:55 B-1 (keynote)

Transformer Cores - 3-dimensional magnetic systems of under-estimated complexity
H. Pfützner, G. Shilyashki, E. Mulasalihovic

11:55-12:15 **B-2**

Effects of compressive stress normal to the surface of grain-oriented Si-Fe sheets

K. Yamamoto, T. Hamada, S. Yanase

12:15-12:35 **B-3**

A domain model for magnetostriction of GO SiFe considering rotational magnetization

G. Shilyashki, H. Pfützner

12:35-12:55 **B-4**

Magnetizing current measurements on full scale power transformers

C. Carrander, G. Engdahl

Lunch

Thursday, September 11

Afternoon Programme

14:45 - 15:40

SESSION C

Session chair: S. Siebert

14:45-15:05 **C-1**

Anisotropy and frequency influence on some properties of electrical steel with Goss texture

W. A. Pluta

15:05-15:20 **C-2**

Stress anisotropy characterisation with the help of Barkhausen effect detector with adjustable magnetic field direction

M. Chmielewski, L. Piotrowski, B. Augustyniak, P. Maciakowski

15:20-15:40 **C-3**

Estimation of magnetocrystalline anisotropy energy from Barkhausen noise measurements in API 5L steels

Tu Le Manh, F. Caleyo, J.M. Hallen, J.A. Perez-Benitez, J.H. Espina

15:40 - 16:30

Posters with coffee and tea

C-4

Measurement method for normal magnetization curve of soft magnetic composites with high magnetization currents

M. Owzareck

C-5

Stress evaluation by Barkhausen signals with a magnetic field sensor

N. Aso, Y. Tsuchida, M. Enokizono

C-6

Evaluation of iron loss calculation models for NO electrical steel sheets excited by PWM voltage of distorted flux density

K. Wajima, K. Fujiwara

C-7

Measurement of iron loss in wound iron core by using visualizing iron loss distribution system

T. Sato, M. Enokizono, H. Shimoji

C-8

Effect of shunt resistor value on the measurement of magnetic properties

S. Zurek

C-9

Measurement of nonsinusoidal current using nanocrystalline current transformers

W. A. Pluta, M. Soinski, C. Swieboda, J. Leszczyński

C-10

Evaluation of the impact of geometry and plastic deformation on the stray magnetic field around the bone-shaped sample

Z. Usarek, B. Augustyniak

16:30-17:45 SESSION D

Session chair: *M. Zucca*

16:30-17:05 D-1

Characterization of the local electrical properties of electrical machine parts with non-trivial geometry

L. Arbenz, A. Benabou, S. Clenet, J. C. Mipo, P. Faverolle

17:05-17:25 D-2

Magnetic coercive field measurement under ultrasonic mechanical excitation

O. Ghibaudo, H. Chazal, N. Galopin, L. Garbuio

17:25-17:45 D-3

Magnetic dummy sensors - a novel concept for interior flux distribution tests

H. Pfützner, G. Shilyashki

20:00 - 23:00

Conference dinner

Friday, September 12 Programme

Morning Programme

09:00 - 10:30 SESSION E

Session chair: *H. Pfützner*

09:00-09:50 E-1 (plenary lecture)

Interpretation and modeling of magnetic power losses in soft magnetic materials

G. Bertotti

09:50-10:10 E-2

A novel 3-D magnetic properties tester with “C-type” cores

Y. Li, Q. Yang, J. Zhu

10:10-10:30 E-3

Comparison of rotational single sheet testers for evaluating 2-D magnetic properties of electrical steel sheet

T. Mori, Y. Takahashi, K. Fujiwara

10:30 - 11:20

Posters with coffee and tea

E-4

Two rotational loss $P_y = f(P_x)$ curve types in electrical steel

S. Zurek

E-5

An investigation into the geometric parameters affecting field uniformity in four pole magnetisers

J. Borg Bartolo, C. Gerada, P. Klimczyk

E-6

Measurement of two-dimensional magnetostriction of a non-oriented electrical steel sheet under shear stress

Y. Kai, M. Enokizono

E-7

A novel magnetizer for 2D broadband characterization of steel sheets and soft magnetic composites

O. de la Barrière, C. Appino, F. Fiorillo, M. Lecrivain, C. Ragusa, P. Vallade

E-8

Vector magnetic properties expressed as parameter of the amplitudes and phase difference of magnetic flux density waveforms

N. Soda, M. Enokizono

E-9

Two-dimensional magnetostriction analysis Using E&S-W model on magnetic core in electrical machines

D. Wakabayashi, M. Enokizono

E-10

Skin effect in magnetic steel sheets under rotating induction

C. Appino, O. Hamrit, F. Fiorillo, C. Ragusa, O. de la Barrière, F. Mazaleyrat, M. LoBue

11:20 - 12:55 SESSION F

Session chair: *E. Cardelli*

11:20-11:55 F-1 (keynote)

Trends of study on vector magnetic characteristic technology

M. Enokizono

11:55-12:15 F-2

Investigating the sources of non-uniformity in 2-D core loss measurement setups

J. Wanjiku, P. Pillay

12:15-12:35 F-3

Two-dimensional magnetostriction of a new electrical steel sheet developed by vector magnetic characteristic control

T. Kajiwara, M. Enokizono

12:35-12:55 F-4

Design of a magnetic structure for inductive power transfer for electric vehicle charge during the motion

V. Cirimele, F. Freschi

Lunch

Friday, September 12

Afternoon Programme

14:45 - 15:45 SESSION G

Session chair: *A. Kedous-Lebouc*

14:45-15:05 G-1 (keynote)

Numerical implementation of the differential hysteresis model

G. Engdahl, S.A. Mousavi

15:05-15:25 **G-2**

Two-dimensional modeling of NOG and OG steels

E. Cardelli, A. Faba, F. Riganti Fulginei, A. Laudani, A. Salvini

15:25-15:45 **G-3**

Loss analysis of an asynchronous multiphase motorgenerator for avionics applications

O. Bottauscio, M. Chiampi, M. Zucca, G. Serra

15:45 - 16:35

Posters with coffee and tea

G-4

Fusion of multiple signals parameters obtained by vector magnetic flux observation for evaluation of stress loaded steel samples

G. Psuj

G-5

Multiparametric analyses of a model transformer core under two basic types of DC bias

H. Pfützner, E. Mulasalihovic, G. Shilyashki, M. Palkovits, G. Trenner, E. Gerstbauer

G-6

Finite element analysis of an incremental permeability based NDT device. Application to dual-phase steels

Y. Gabi, A. Kedous-Lebouc, G. Meunier, O. Geoffroy, P. Labie, P. Meilland, C. Guerin, B. Wolter

G-7

Automatic 3-dimensional flux analyses of a 3-phase model transformer core

G. Shilyashki, H. Pfützner, P. Hamberger, M. Aigner, M. Palkovits, G. Trenner, E. Gerstbauer

G-8

A comprehensive approach to broadband characterization of soft ferrites

C. Beatrice, F. Fiorillo

16:35 - 17:35

SESSION H

Session chair: Y. Li

16:35-16:55 **H-1**

A suitable method for characterization of ferrofluids or low-permeability materials and their anisotropic behavior

M. Petit, A. Kedous-Lebouc, O. Geoffroy, Y. Avenas, W. Cherief

16:55-17:15 **H-2**

Stroboscopic investigation of domain wall motion at high frequencies

A. Magni

17:15-17:35 **H-3**

The applicability of nanocrystalline stacked cores for power electronics

M. Soinski, J. Leszczynski, C. Swieboda, M. Kwiecien

17:35-17:45 Closing address

18:30 - 22:30

Cocktail and Concert